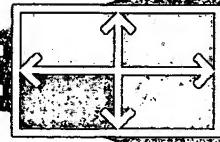


Appendix H

C3 Design Review

POST Tools
Project

PAYLOAD OPERATIONS SUPPORT TEAM
FIT TO FLY



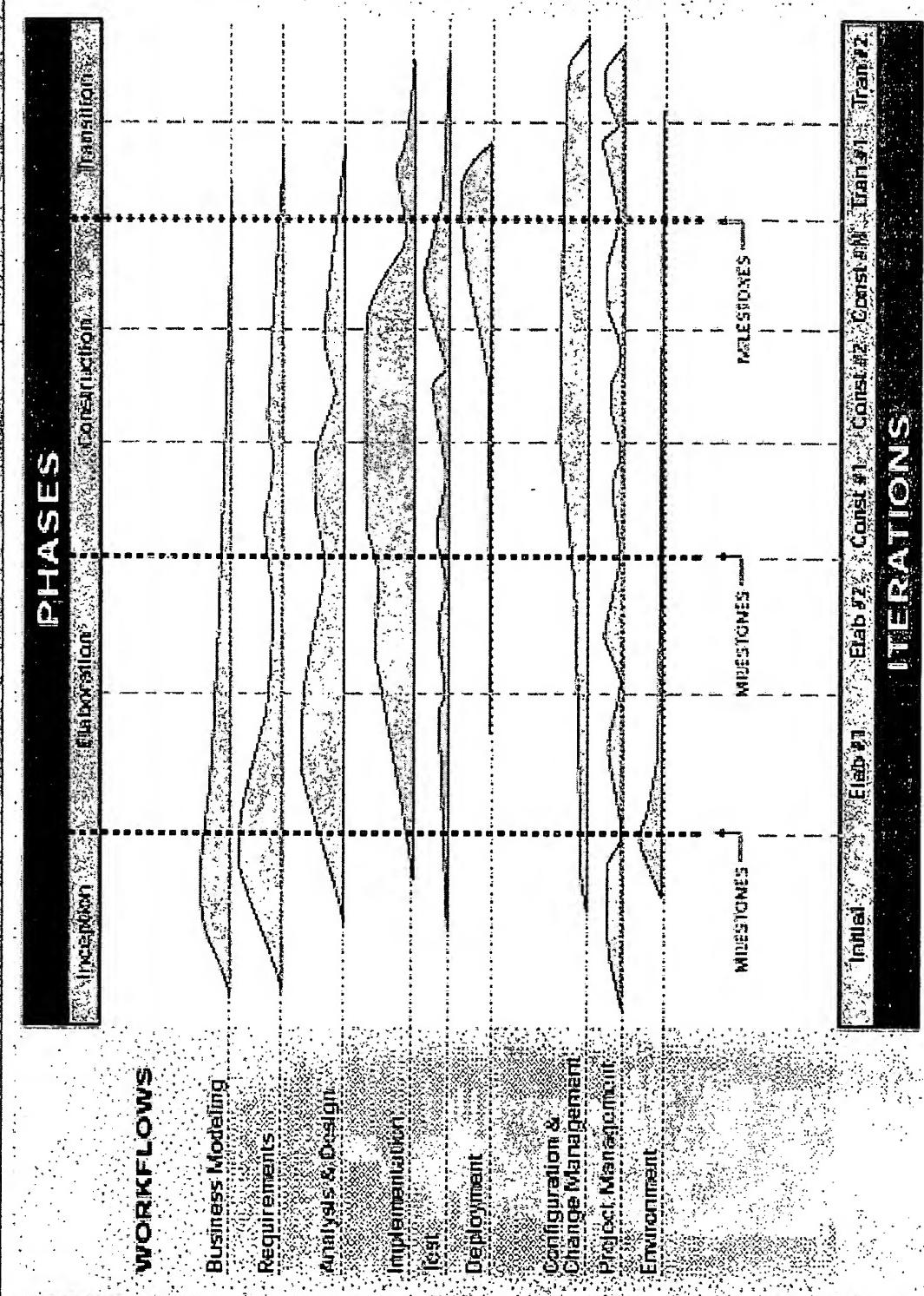
Agenda

- Project Overview
- Software Engineering
- Hardware Engineering
- Test Plans and Acceptance
- Summary
- Demonstrations

Project Overview

- Iterative process allowed early focus on architecture and risk
 - Mostly QIB and CDT
 - Later focus on completing scope
- Mostly CDT, MOT, SMT, PDB
- Coordination with projects
 - P/T, Cargo PC, Flight Similar
- Pursued and chose COTS for SDR

Iterative Process



Schedule

Start	11/01/99
Inception Phase Complete	12/15/99
Lifecycle Architecture (SRR)	04/12/00
Design Review (PDR/CDR)	07/26/00
Release 0.0 (IOC)	11/22/00
Release 1.0 (RFQ)	03/21/01
• Design Review (C3)	05/03/01
• Release 2.0 (RFD)	08/22/01
• Transition Review (ORR)	12/05/01
• Product Release	06/27/02

Metrics

Colouring

- Software complexity metrics
- Snapshot metrics by iteration
- Dynamic metrics across iterations
- Artifact completion

Calculating earned value with PX

State Measured at C2

- 61 change orders, 60 closed
- 113 use cases
- 5,116 wicket points
- 6,255 source files
- 27,723 loc/or hours
- 1,071,098 lines of code

Engineering
Software
Custom Solutions

Custom Software

- Architecture complete
- CDT, MOT, PDB, SMT, and QJB have custom elements
- Data model complete
- Product definitions complete
- Finishing scope during C3

COTS Software

- Wind River Systems VxWorks 5.4
- Wind River Systems MATRIX 7.0
- Silver Stream Application Server 3.5.2
- Microsoft Visual Studio 6.0
- Microsoft Windows NT 4 SP5
- Microsoft Visual Source Safe 6.0
- Microsoft SQL Server 7.0
- Microsoft Internet Explorer 5.x+
- Intranet Solutions Xpedio Content Server 4.5
- Symantec pcAnywhere 9.2

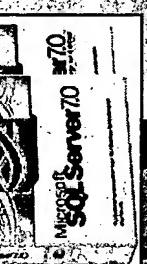
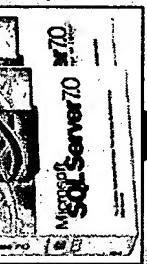
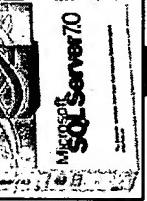
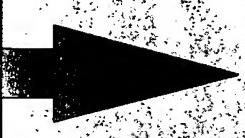
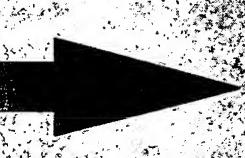
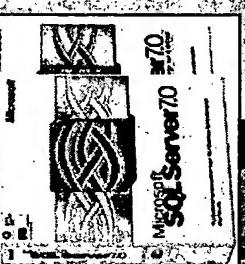
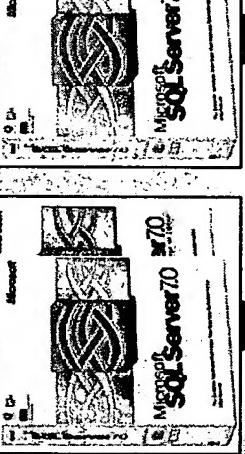
Implementation Working Group

NOT SORRY BUT PDB BIG



SilverStream®

Xpedio



Command and Data Tool

- CDT-PIT IDD complete
- Remaining work
 - C2 Adjusted Requirements and Implementation
 - Changes to Data Collection Forms
 - C3 Scheduled Implementation
 - = CDT-01C: NASA Reconstructed Formats
 - CDT-01C: Customer / NASA Format Mapping Summary
 - CDT-01D: Define Command Structures
 - CDT-01S: Parameter Review
 - CDT-01Q: Manage Standard Orbiter Parameters for WinDecom
 - CDT-07B: Additional Payload XML Products - Hazardous Command Structures and Standard Orbiter Parameters
 - Capture and Produce Annex 4 Text

Command and Data Tool

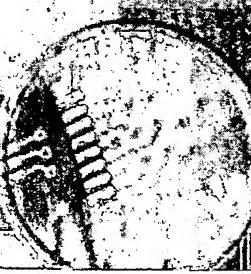
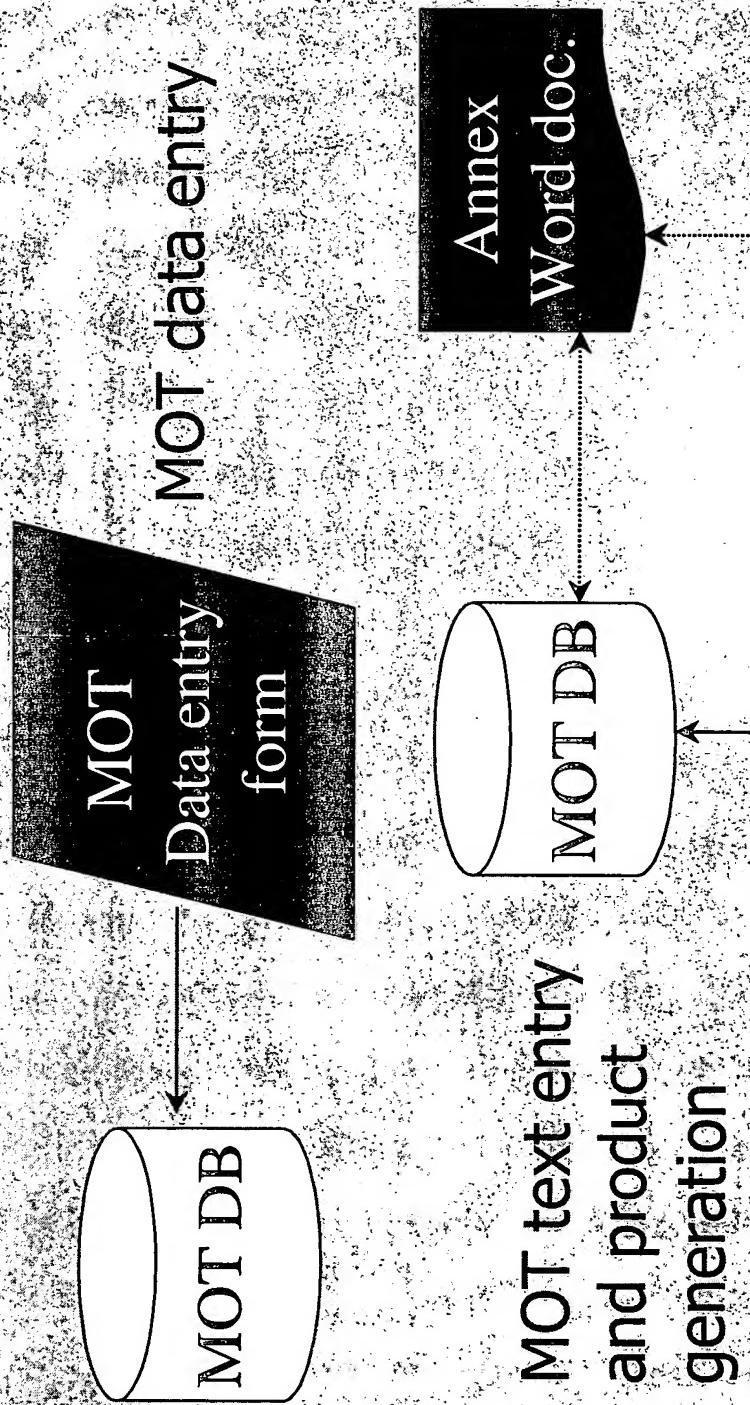
- Remaining work (continued)

- Audit Capability Integration
 - CDT-10: Collect Audit Data Requirements - Implement forms required to gather audit requirements (data record definition and audit rules)
 - CDT-09: Audit Payload Data - provide interface to gather and prepare data for audit tool
- New Requirements
 - Generic MSID For P/L Applications Field Testing

Mission Operations Tool

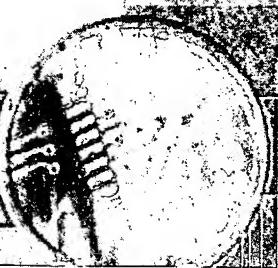
- C3 use cases complete
- Combination blank books and DB
 - Enter table data through forms
 - User friendly data entry forms to capture book table data
 - Edit blank book text
 - Text entry through MS Word for product generation
 - Blank book linked to table data
 - Linked data tables in MS Word document for most recent data
- CM as integrated package
 - Word document checked in and out of MOT database

Mission Operations Tool



Mission Operations Tool

- Remaining work
 - Integrated test
 - Document schedule viewing for all documents



Orbiter-in-a-Box

- C3 use cases complete
- Remaining work
 - PSP implementation
 - MDM implementation
 - PDI reconfiguration implementation
 - Multi-GPC operation
 - Integrated test
 - Plug-n-Play Interfaces
- Configurations tools, WEB pages, and Starter Scripts
- Local file system layout

Orbot-in-a-Box

Capabilities

CPC Emulator

NIC Support

SMS Modes

Hard or Soft Payload

ISP Server

Web Server

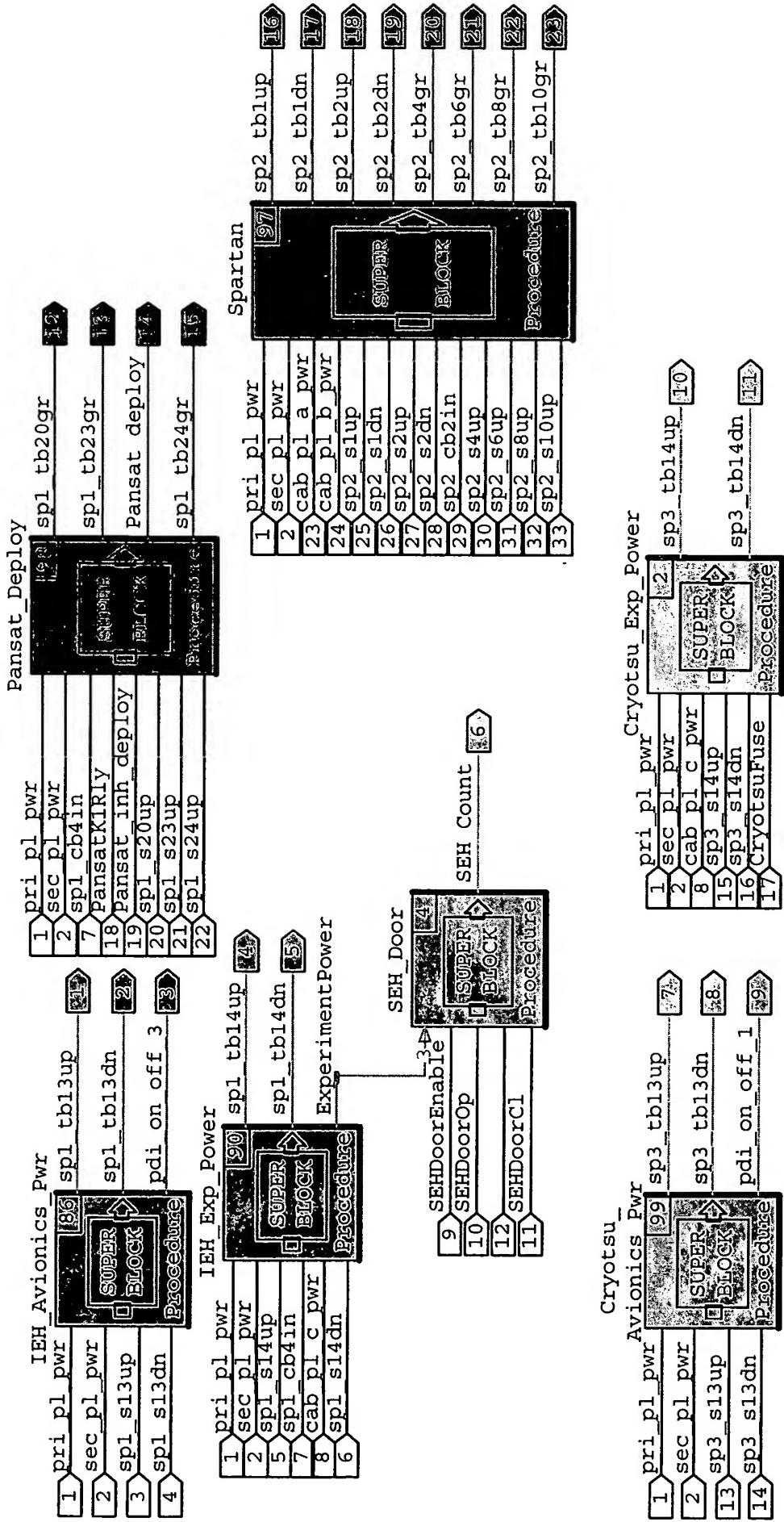
Payload Model Server

Task Manager

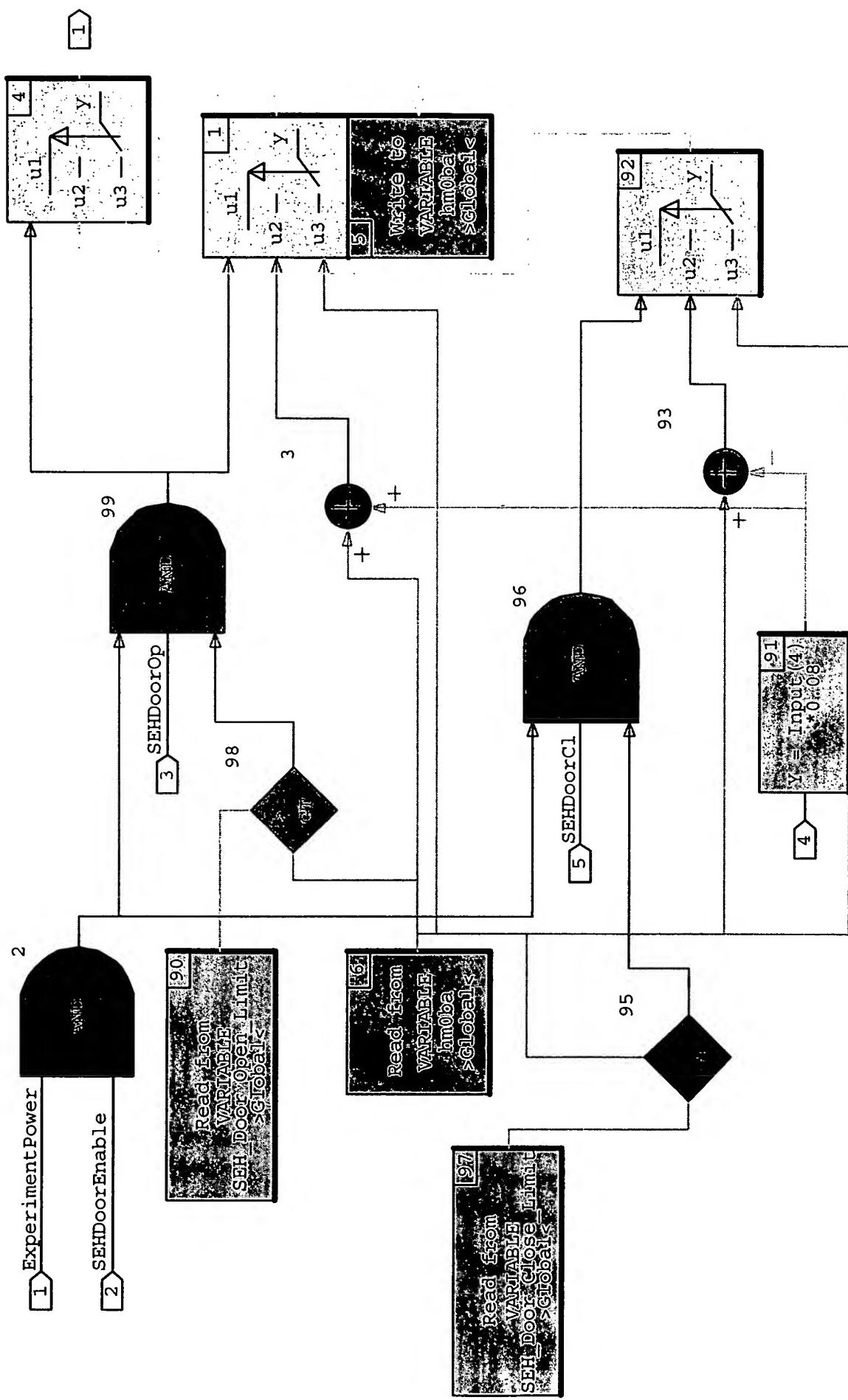
SMS Model Tool

- C3 use cases complete
- PLS compatibility verified
- PLS-OlaB migration verified
- Remaining work
 - Incorporate PDB-ISPs Links into Payload Model Templates
 - Integrated test

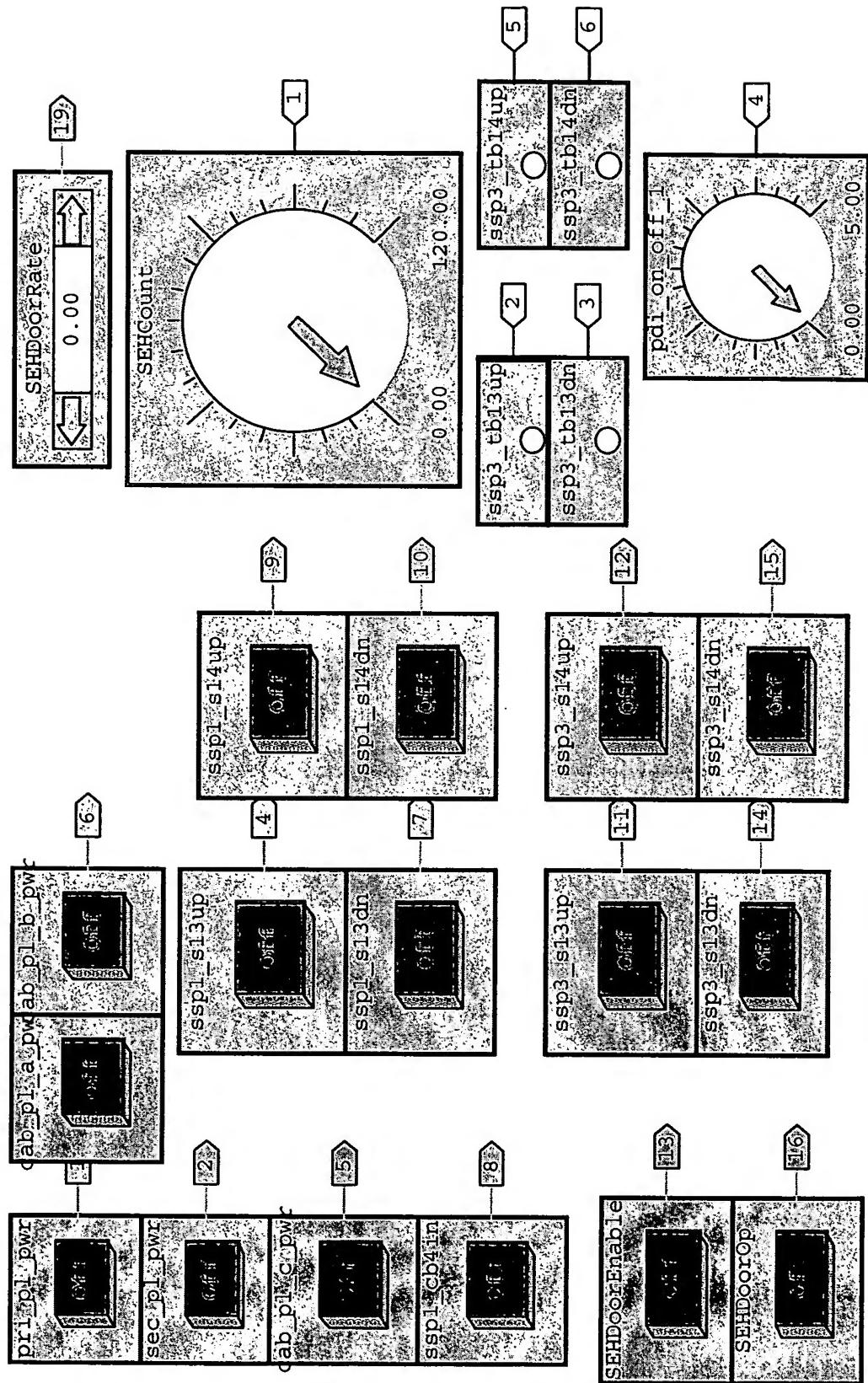
Top Level MatrixX Payload Model



MatrixX Payload Model



Interactive Controls Within MatrixX



Portable Display Builder

- C3 use cases complete

- Beans include:

Custom Time Clock	Button Group
Meter / Gauge Dial Bean	Slider Bar
Symbol Data Icon - Talkback bean	Text - Data Driven Text
SMS Commanding - Publish Capability	RtParameter Bean
Msksview - Matrix Bean	ISP Data Provider Bean
Icon Editor and Generic Bean	Linear Meter Bean
Action Object Icon	Curved Line Plot / Trend
ISP NT Server Software Certified	

- CPC platform support verified

- Remaining work

- Complete Beans
 - Generic Format Editor
 - PDB Commanding

Shared Data Repository

C3 Use cases complete

- Legacy import/export not in scope

• Implementation with Xpedio

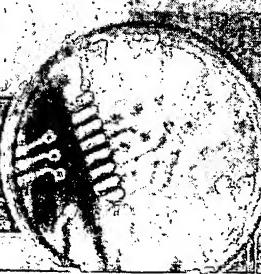
• Remaining work:

- Define workflows

- POST graphics

- VPN installation

- Test



Implementation Details

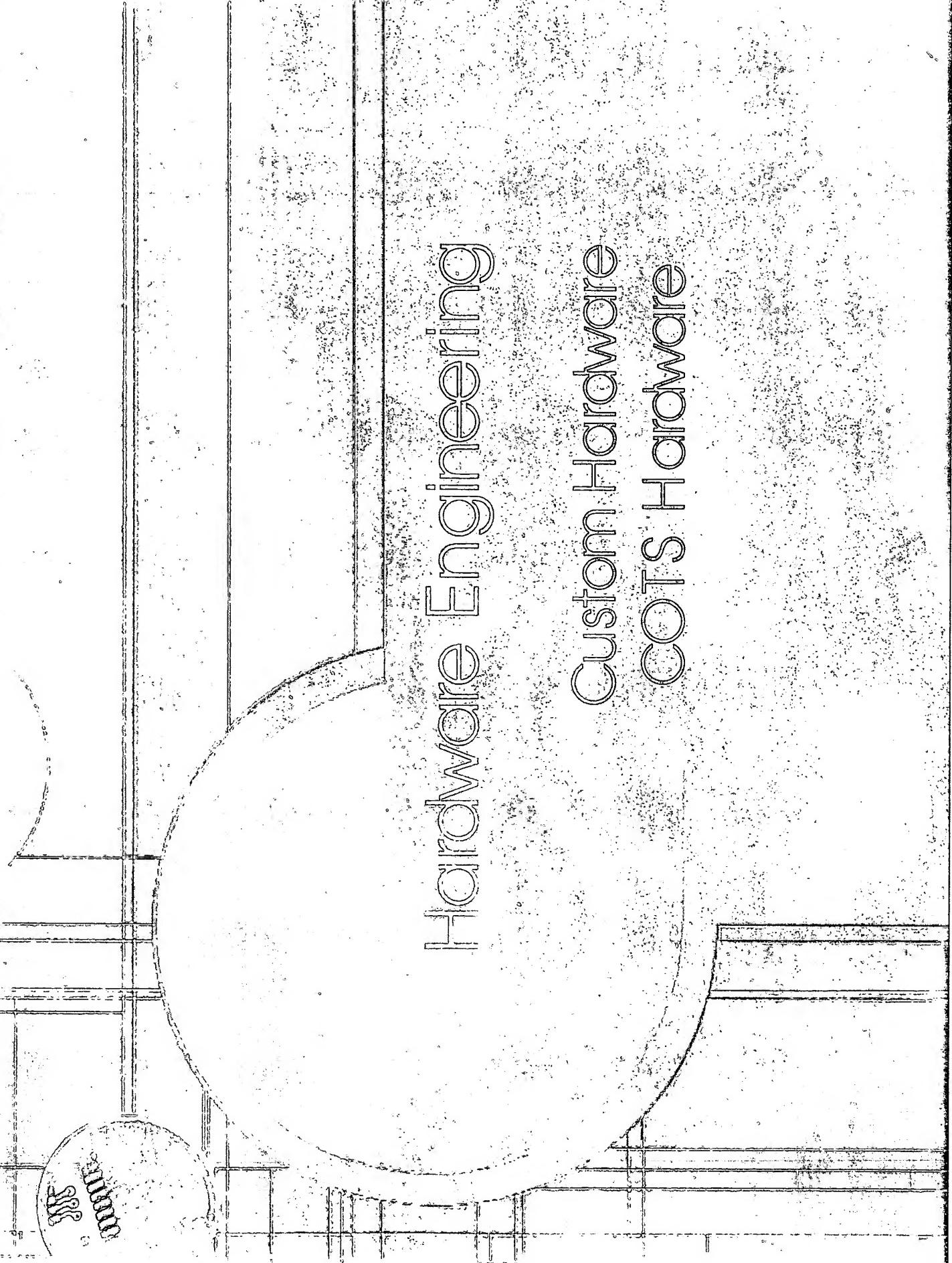
- SDR is on the POST Server
- Content is viewable as PDF and html, where applicable
- Content is downloaded in native format
- Required metadata fields include the status of the document and entry into a workflow
- POST Server is protected by a VPN

Authentication

- User authenticates on the VPN using a digital certificate and password - protects the POST server
- User authenticates with the SDR using an X.509 username and password - protects content

SDR content Access Controls

- Security Groups control access to different payloads
- Security Groups control access to "frozen" payload products
- Users belong to one or more Security Groups
- Users are assigned Roles in a Security Group
- Roles are: Admin, Contributor, Reviewer
- Permissions are assigned to each Role:
Read, Write, Delete, Admin



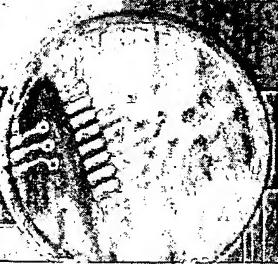
GLENSTAR
Engineering
Hardware

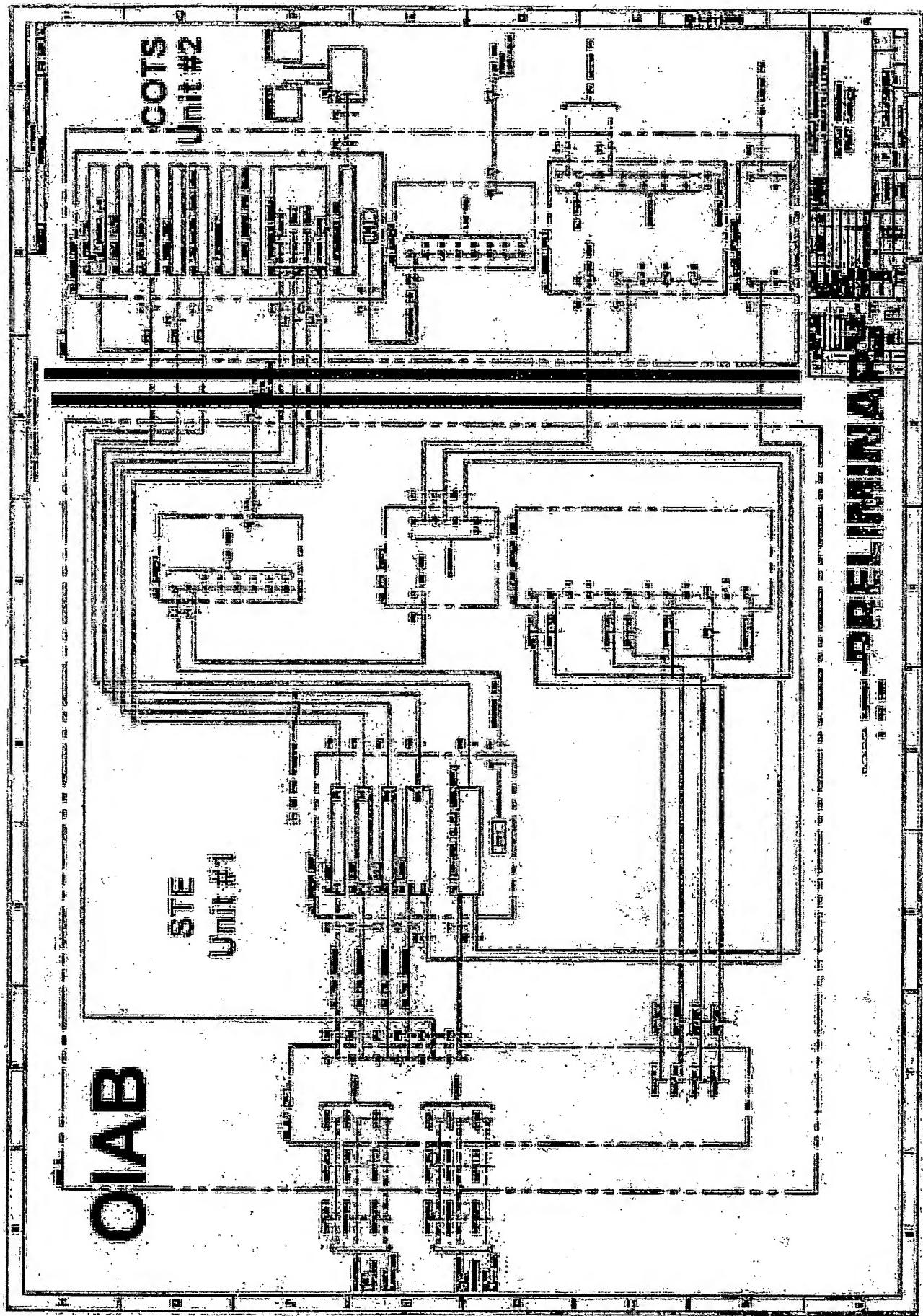
• Two Unit System

- Unit #1 - COTS HW

- Unit #2 - Custom HW
- Test Equipment (STD)
- Special Requests

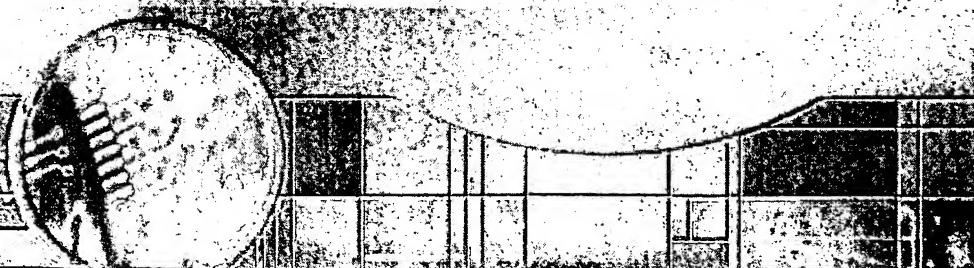
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Custom Hardware - General

- I/O optically isolated
- Designed for
 - Appropriate fusing
 - Over-volt protection
 - Fault voltage emission
 - Fault current limitation



Custom Hardware

- Standard Switch Panel (SSP)
- Multiplexer/DeMultiplexer (MDM) I/O
- Payload Signal Processor (PSP)
- Payload Data Interleaver (PDI)
- Pulse Code Modulation Master Unit (PCM/MU)
- Cargo PC
- Power
- Interfaces

Custom Hardware - SSP

- Fully functional standard switch panels
- The SSPs duplicate flight panel
 - Simulation panels components used in place of flight components to reduce cost
 - Connectors MIL rated.
- Panels will be 19" rack mounted
- Design for 1 or 2 SSP panels per POST system

Custom Hardware - MDM I/O

- MDM Input and Output Cards
 - Low-level differential analog inputs (A/D)
 - Low-level discrete inputs (D/I/L)
 - Low-level discrete outputs (D/O/L)
 - High-level discrete outputs (D/O/H)
- Signal conditioning accomplished on custom designed VME boards to duplicate Shuttle MDM characteristics
- In/out/output portion of Shuttle IOM boards duplicated
- Boards driven by COTS I/O boards and will present the same electrical interface to payload as flight equipment

Custom Hardware - ADI

- Two analog differential inputs
- Acromag IP320 12-bit high density analog input board provides input interface to the VME chassis backplane
- A POST custom designed VME board will provide Shuttle MIDVME electrical interface to Payload

Custom Hardware - DIL

- Eight low-level discrete inputs TTL-5 volt
- Acromag IP440-1 32-Channel Isolated Digital Input Module with Interrupts will provide the input interface to the VME chassis backplane 4 to 18 volts
- A POST custom designed VME board will provide Shuttle MDM I/OV electrical interface to Payload

Custom Hardware - DOL

- Eight low-level discrete outputs
- Acromag IP445 32-Channel Isolated Solid State Relay Discrete Output Module will provide the low level output interface to the VME chassis backplane
- A POST custom designed VME board will provide ShuttleMDM IOM electrical interface to Payload

Custom Hardware - DOH

- Four high-level discrete outputs
- Acromag P445 32-Channel Isolated Solid State Relay Discrete Output Module will provide the high level output interface to the VME chassis backplane
- A POST custom designed VME board will provide Shuttle MDM IOM electrical interface to Payload

Custom Hardware - SIO

- One MDIMI SIO port
- A SBS SDIO-PCM2-1 PCMI/A card will supply the port
- The PCMI/A card will be installed in the VGV/5 single board computer board in the provided PCMI/A slot.
- The SBS board was custom designed for this use and meets all orbiter specifications.
- The SIO signal will be interface to the Customer provided Cargo PC through a PDIP panel provided by POST.
 - It will provide the same panel connector as a flight PDIP panel

Custom Hardware - PSP

- One command stream will be provided for the Payload
- SBS 4416VF PCM Simulator Card provides the PSP PCM output interface to the VME chassis backplane
- The SBS module provides a single ended 500 mV
- The orbiter PSP output is a differential 3.2 to 4.4 V P-P
- A custom designed/built interface will be provided to odd convert from single ended to differential drive and to raise the signal level from 500 mv to 4 V P-P

Custom Hardware - PDI

- One Payload Data Interleaver port
- A SBS 4422-V64 with a 4400-TF Tunable Bit Synchronizer Module will provide PDI function
- The SBS boards do not meet following orbiter specs
 - Bit Rate - The PDI can process an input stream as slow as 10 bps, but the SBS bit sync card can only sync to streams as slow as 200 bps. By using separate clock and data inputs into the SBS 4422 card, the 10 bps rate can be achieved.
 - Master Frame Sync - The SBS 4422 card can not sync on a static master frame sync pattern. If there is an 8 bit minor frame counter, the start of the master frame can be determined.

Custom Hardware - PCMMU

- One command streams will be provided
- SBS 4416VF PCM Simulator Card provides the Pulse Code Modulation Master Unit (PCMMU) PCM output interface to the VME chassis backplane
- The SBS module provides a single ended 500 mv
- The orbiter PSP output is a differential 3.2 to 4.4 V P-P
- A custom designed/built interface will be provided to odd convert from single ended to differential drive and to raise the signal level from 500 mv to 4 V P-P
- This signal will be provided to the Cargo PC with a partial shuttle panel O5. The panel will only contain the PCMMU connectors.

Custom Hardware

- The Cage DC with a PC/MIA MDM-SIC port will be a customer provided item.
- The only payload power which will be provided by OLAB will be power associated with the SSP and the MDM interface boards.
- The OLAB will provide Mil rated connections for customer provided code to connect the POST to the Pay load.

COTS Hardware

- Synergy single board computers
- SBS avionics and telemetry cards
- Red Rock hard drives
- Ramix LAN switches
- System reflective memory network
- Acromag analog/discrete cards
- Backplanes, card cages, racks
- TrueTime time code generators
- Dell workstations, Compaq server
- Nokia VPN gateway, Check Point firewall

Cable Plan

- Customer provides
 - Payloc SIP
- SENCO provides
 - OiAB to SIP
 - OiAB "lite" to CPC
- Network crossovers
- CPC provides
 - CPC to PDIP (MIC)
 - CPC to O5 (PCM/MU, DC)

Hardware

Software

Implementation Plan



Operations Flow

- OIABS and Tools PC depot in LSF
- SR to SEMO to ship
- SDR coordinator builds customer package
- Tools PC and OIAB configured for shipping- Acceptance/Checkout Test
- Units shipped: DRD 1149, 1602
- Field support to customer as required

Operations Flow - Cont.

- Vendor updates tracked and implemented
- Units received back from vendor and re-furnished.

Integrated

Hardware

Software

TECHNOLOGY
MANUFACTURING



Software

- Test plan
- Unit tests
- Test cases
- Manual test procedures
- Automated test scripts
- Non-functional tests

Hardware

- Custom hardware test per TPS
- Analysis support FMEA/CIL
- Integrated COTS test support



Integrated

Configuration tests

• End-to-end tests

- Process endpoints

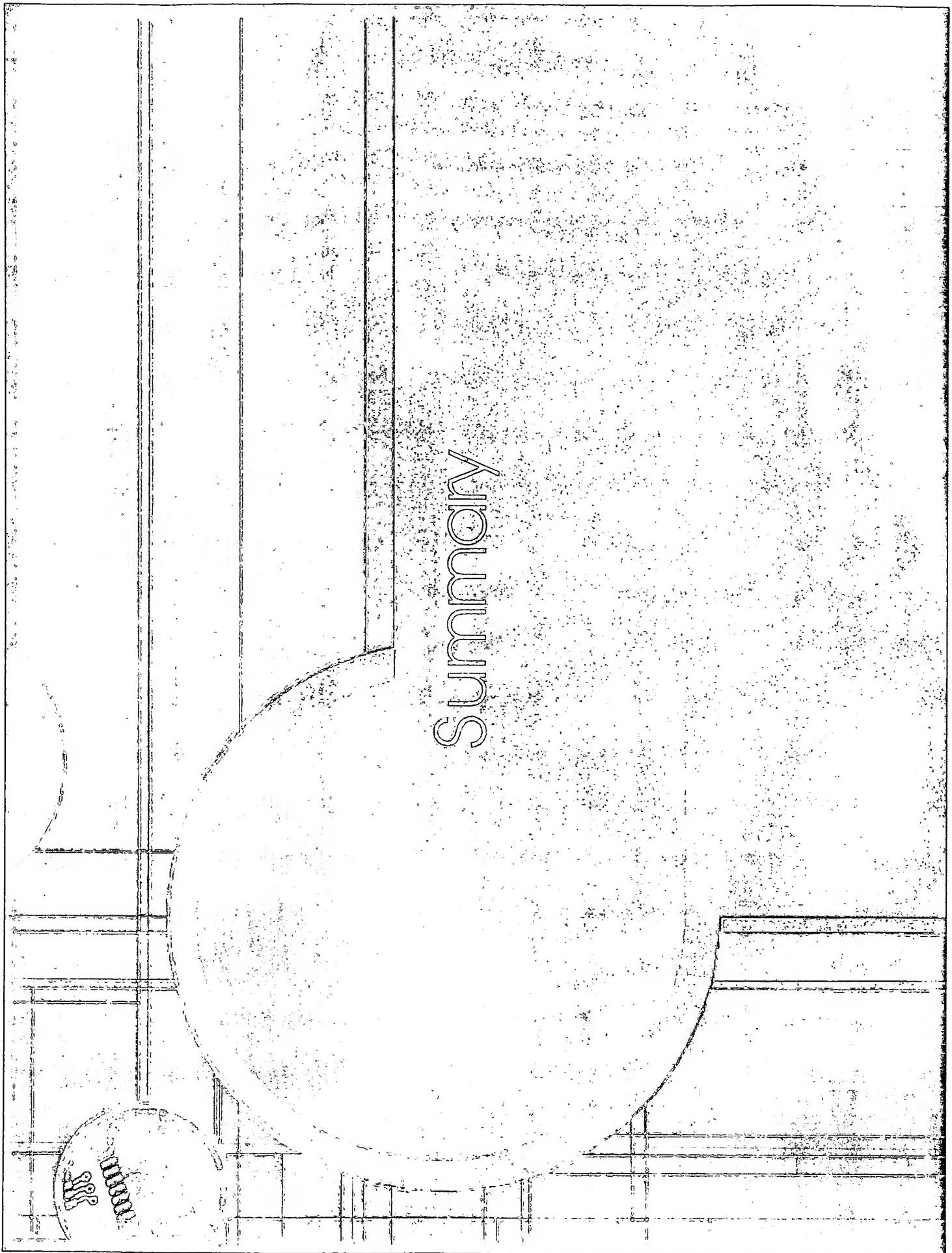
= HST-OiaB-CPC-PDB+tests

- SMT-OiaB-PDB+tests

• Performance tests

Integrated build tests

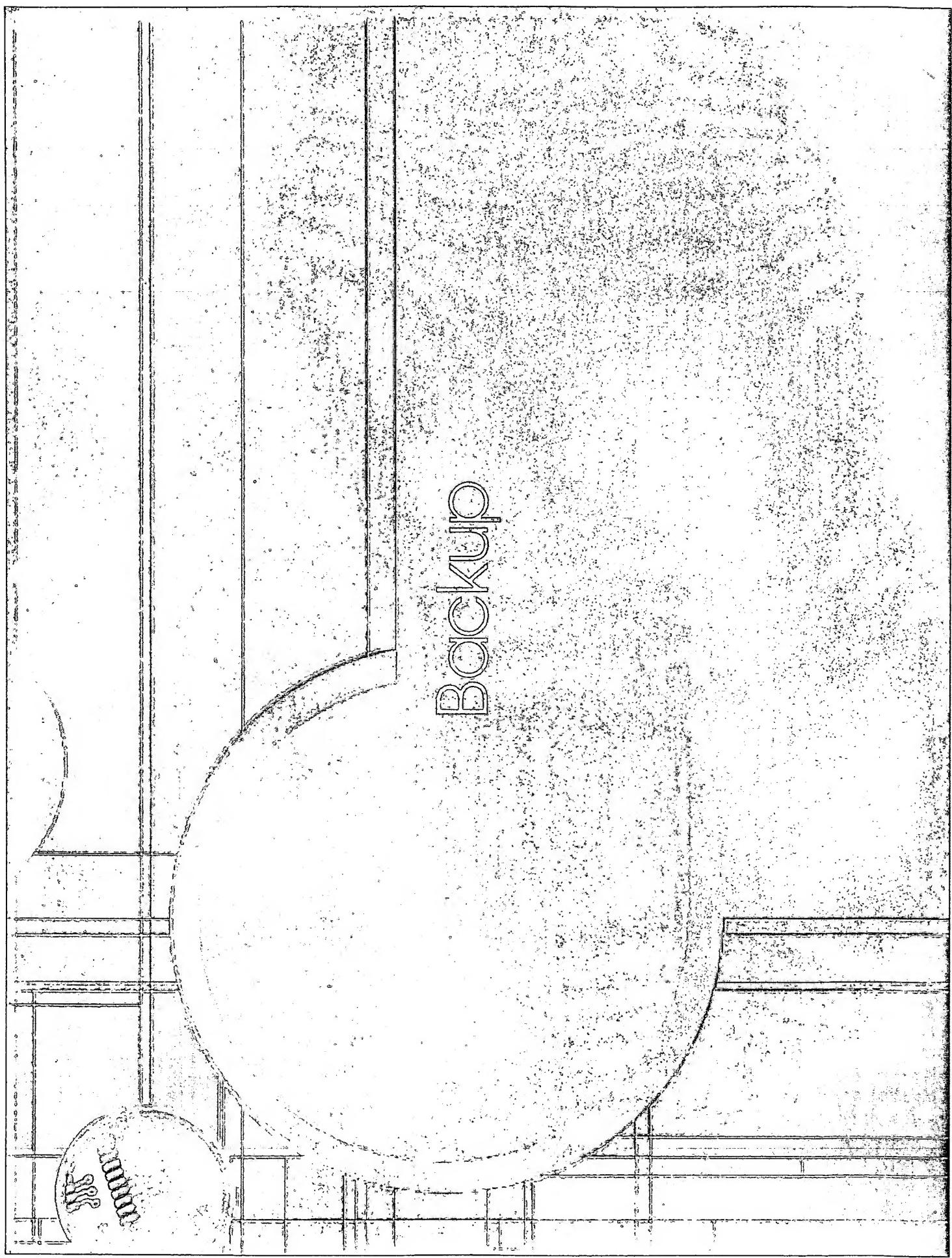
Summary



Summary

- Software nearing completion
- Hardware nearing completion
- Requirements are stable
- Eliminating risks and uncertainties
- Preparing QPS and support workflow
- Focus on testing
- Focus on POST demonstration

BACKUP



SDR Access Control Example

- Jack belongs to security groups PL1 and PL2
- Jack's role is contributor for PL1 and reviewer for PL2.
- Jack can read and edit content that belongs to PL1.
- Jack can read content that belongs to PL2.

SMT AutoCode Code Segment from Previous Model

```
***** Procedure: Cryotsu *****/
void Cryotsu( )

/*----- Local Block Outputs -----*/
RT_INTEGER ExperimentPower;
RT_INTEGER OutputUpdate; *****/
/*----- Procedure Super Block -----*/
/* {IEH_Avionics_Evr86} */
IEH_Avionics_Pwro;
IEH_Avionics_Pwro;

/*----- Procedure Super Block -----*/
/* {IEH_Exp_Power_90} */
IEH_Exp_Power(&ExperimentPower);
/*----- Procedure Super Block -----*/
/* {SEH_Door_4} */
SEH_Door(ExperimentPower);
/*----- Procedure Super Block -----*/
/* {Cryotsu_Avionics_Pwr.99} */
Cryotsu_Avionics_Pwr0;
/*----- Procedure Super Block -----*/
/* {[Cryotsu_Exp_Power_2]} */
Cryotsu_Exp_Pwro;
/*----- Procedure Super Block -----*/
/* {[Pansat_Deploy_98]} */
Pansat_Deploy();
/*----- Procedure Super Block -----*/
/* {[Spartan.97]} */
Spartan();
return;
```